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मानक

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Jawaharlal Nehru

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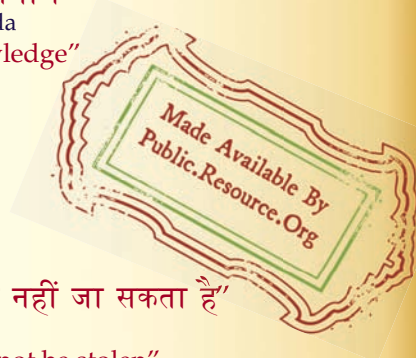
IS 2032-13 (1971): Graphical symbols used in electrotechnology, Part 13: Microwave tubes [LITD 4: Electron Tubes and Display Devices]



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“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

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IS : 2032 (Part XIII) - 1971

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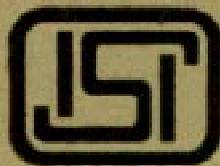
Indian Standard

GRAPHICAL SYMBOLS USED IN ELECTROTECHNOLOGY

PART XIII MICROWAVE TUBES

(First Reprint JANUARY 1984)

UDC 00'362 : 621'385'6



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INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Indian Standard

GRAPHICAL SYMBOLS USED IN ELECTROTECHNOLOGY

PART XIII MICROWAVE TUBES

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(Continued from page 1)

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Indian Standard

GRAPHICAL SYMBOLS USED IN ELECTROTECHNOLOGY

PART XIII MICROWAVE TUBES

0. FOREWORD

0.1 This Indian Standard (Part XIII) was adopted by the Indian Standards Institution on 26 March 1971, after the draft finalized by the Electrotechnical Standards Sectional Committee in consultation with the Electron Tubes and Valves Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 It is common in electrical and electronic engineering practice to employ graphical symbols to denote the various means and devices used when making diagrams of connections. The connecting devices and the points where they make contact with the apparatus may be indicated in the diagram. With the object of standardizing the symbols to meet the various needs of the electrical and electronic industry, as far as possible, based on symbols internationally agreed, a series of standards is being formulated.

0.3 In selecting and devising these symbols the object has been to ensure, as far as possible, that they are self-explanatory, easy to draw and in general use. It may be necessary in detailed diagrams to indicate the physical structure of the apparatus, the actual position of the terminals and so forth, but, where possible, the principle of the standard symbols should be followed.

0.4 It may be possible that for the items specified in this standard other symbols are used in this country. However, in the interest of the unification in the use of these symbols, only one symbol based on the internationally agreed symbols for each of the devices has been specified.

0.5 While preparing this standard, assistance has been derived from the IEC Pub 117-11 'Recommended graphical symbols, Part 11 Microwave technology' issued by International Electrotechnical Commission.

0.6 This standard is one of the series of Indian Standards for graphical symbols used in electrotechnology.

1. SCOPE

1.1 This standard (Part XIII) covers graphical symbols for microwave tubes.

2. PARTICULAR ELEMENTS FOR TUBES

2.1 Electron Gun Assembly (Set of Electrodes Forming an Electron Gun) — Simplified representation.



2.2 Reflector



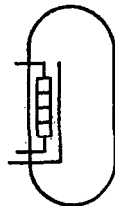
2.3 Non-emitting Sole, to be Used in Conjunction with Non-re-entrant Slow-Wave Structure



2.4 Non-emitting Sole, to be Used in Conjunction with Re-entrant Slow-Wave Structure



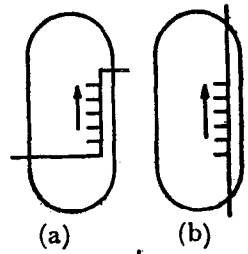
2.5 Preheated Non-emitting Sole



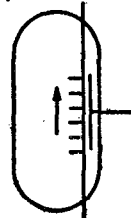
2.6 Emitting Sole — Arrow indicates direction of electron flow.



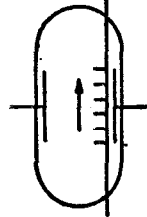
2.7 Non-re-entrant Slow-Wave Structure —
 Arrow indicates direction of energy flow.



2.8 Electrode for Electrostatic Focusing Along Non-re-entrant Slow-Wave Structure



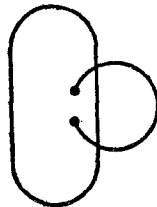
2.9 Pair of Electrodes for Electrostatic Focusing Along Non-re-entrant Slow-Wave Structure



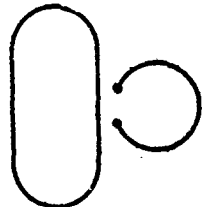
2.10 Re-entrant Slow-Wave Structure



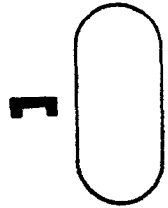
2.11 Resonator, Forming an Integral Part of Tube



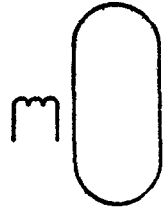
2.12 Resonator, Partly or Wholly External to Tube



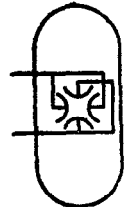
2.13 Permanent Magnet Producing a Transverse Field (Crossed-Field or Magnetron-Type Tube)



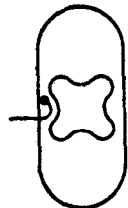
2.14 Electromagnet Producing a Transverse Field (Crossed-Field or Magnetron-Type Tube)



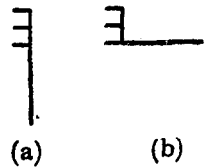
2.15 Tetrapole



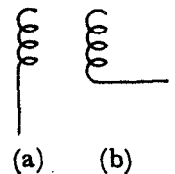
2.16 Tetrapole with Loop Coupler



2.17 Slow-Wave Coupler



2.18 Helical Coupler



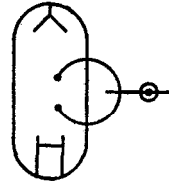
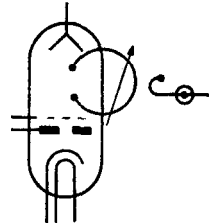
3. EXAMPLES OF TUBES

NOTE 1 — The graphical representation of any one tube should show only those elements and details which are, for the purpose of the drawing or diagram, relevant to a correct interpretation or necessary for showing circuit connections or both.

NOTE 2 — The relative position of the various tube element symbols is no indication of the geometry of the tube structure.

3.1 Reflex Klystron with :

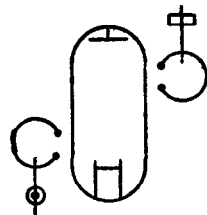
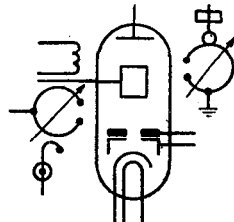
- a) indirectly heated cathode;
- b) beam-forming electrode;
- c) grid;
- d) tunable integral cavity resonator;
- e) reflector; and
- f) loop coupler to coaxial output.



3.1.1 Simplified Form

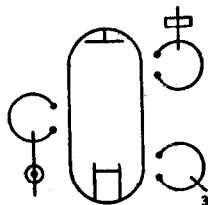
3.2 Klystron with:

- a) indirectly heated cathode;
- b) intensity modulating electrode;
- c) beam-forming electrode;
- d) external tunable input cavity resonator;
- e) drift space electrode;
- f) external tunable output cavity resonator with dc connection;
- g) collector;
- h) focusing coil;
- j) input loop coupler to coaxial waveguide; and
- k) output window coupler to rectangular waveguide.



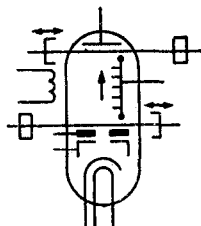
3.2.1 Simplified Form

3.2.2 Simplified Form A Klystron with Five External Cavity Resonators — The numeral (for example, 3) indicates the number of cavity resonators represented by only one cavity resonator symbol.

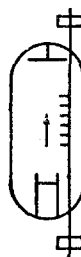


3.3 O-Type Forward Travelling Wave Amplifier Tube with:

- indirectly heated cathode;
- intensity modulating electrode;
- beam-forming electrode;
- slow-wave structure with dc connection;
- collector;
- focusing coil; and
- probe-couplers to rectangular waveguides each with sliding short.

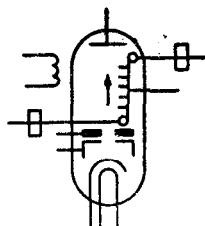


3.3.1 Simplified Form for Forward Travelling Wave Amplifier Tube (with Couplers to Rectangular Waveguides)



3.4 O-Type Forward Travelling Wave Amplifier Tube with:

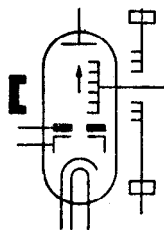
- indirectly heated cathode;
- intensity modulating electrode;
- beam-forming electrode;
- slow-wave structure with dc connection;
- collector;
- focusing coil; and
- window couplers to rectangular waveguides.



3.4.1 Simplified Form — See 3.3.1.

3.5 O-Type Forward Travelling Wave Amplifier Tube with:

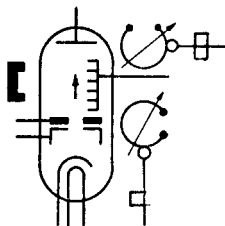
- indirectly heated cathode;
- intensity modulating electrode;
- beam-forming electrode;
- slow-wave structure with dc connection;
- collector;
- permanent focusing magnet; and
- slow-wave couplers to rectangular wave-guides.



3.5.1 Simplified Form — See 3.3.1.

3.6 O-Type Forward Travelling Wave Amplifier Tube with:

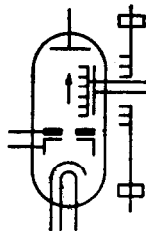
- indirectly heated cathode;
- intensity modulating electrode;
- beam-forming electrode;
- slow-wave structure with dc connection;
- collector;
- permanent focusing magnet; and
- window couplers between external tunable cavity resonators and rectangular wave-guides.



3.6.1 Simplified Form — See 3.3.1.

3.7 O-Type Forward Travelling Wave Amplifier Tube with:

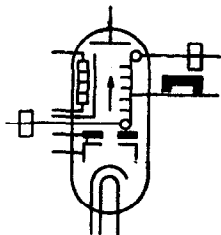
- indirectly heated cathode;
- intensity modulation electrode;
- beam-forming electrode;
- slow-wave structure with dc connection;
- electrostatic focusing electrode;
- collector; and
- slow-wave couplers to rectangular wave-guides.



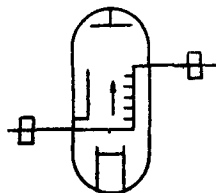
3.7.1 Simplified Form — See 3.3.1.

3.8 M-Type Forward Travelling Wave Amplifier Tube with:

- a) indirectly heated cathode;
- b) intensity modulating electrode;
- c) beam-forming electrode;
- d) preheated non-emitting sole;
- e) slow-wave structure with dc connection;
- f) collector;
- g) permanent transverse field magnet; and
- h) window couplers to rectangular waveguides.

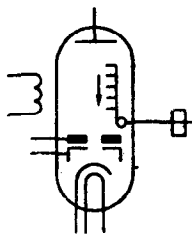


3.8.1 Simplified Form

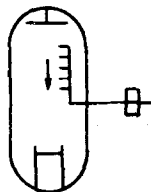


3.9 O-Type Backward Travelling Wave Oscillator Tube with:

- a) indirectly heated cathode;
- b) intensity modulating electrode;
- c) beam-forming electrode;
- d) slow-wave structure with dc connection via waveguide;
- e) collector;
- f) focusing coil; and
- g) window coupler to rectangular waveguide.

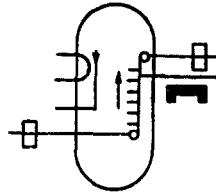


3.9.1 Simplified Form

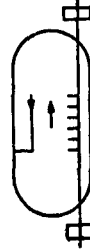


3.10 M-Type Backward Travelling Wave Amplifier Tube with:

- a) filament-heated emitting sole;
- b) slow-wave structure with dc connection;
- c) permanent transverse-field magnet; and
- d) window-couplers to rectangular waveguides.

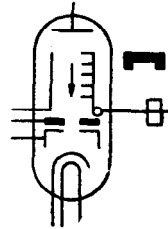


3.10.1 Simplified Form

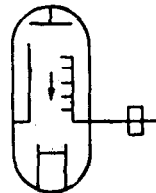


3.11 M-Type Backward Travelling Wave Oscillator Tube with:

- a) indirectly heated cathode;
- b) intensity modulating electrode;
- c) beam-forming electrode;
- d) non-emitting sole;
- e) slow-wave structure with dc connection via waveguide;
- f) collector;
- g) permanent transverse-field magnet; and
- h) window-coupler to rectangular waveguide.

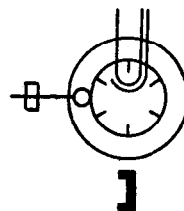


3.11.1 Simplified Form

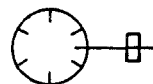


3.12 Magnetron Oscillator Tube with:

- a) indirectly heated cathode;
- b) re-entrant slow-wave structure with dc connection via waveguide;
- c) permanent magnet; and
- d) window-coupler to rectangular waveguide.

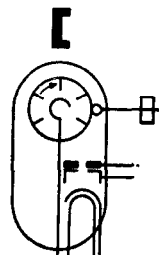


3.12.1 Simplified Form



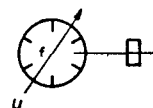
3.13 Voltage Tunable Magnetron with:

- a) indirectly heated cathode;
- b) intensity modulating electrode;
- c) beam forming electrode;
- d) re-entrant slow-wave structure with dc connection via waveguide;
- e) non-emitting sole;
- f) permanent magnet; and
- g) window-coupler to rectangular waveguide.



3.13.1 Simplified Form

U = voltage tunable magnetron, and
 f = frequency of operation.



(Continued from page 2)

Panel for Microwave Tubes, ETDC 39 : 5

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Ministry of Defence

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

Quantity	Unit	Symbol
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

Quantity	Unit	Symbol
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

Quantity	Unit	Symbol	Definition
Force	newton	N	1 N = 1 kg.m/s ²
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m ²
Frequency	hertz	Hz	1 Hz = 1 c/s (s ⁻¹)
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m ²

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117/418 B Sarvodaya Nagar	KANPUR 208005	4 72 92
Patliputra Industrial Estate	PATNA 800013	6 28 08
Hantex Bldg (2nd Floor), Rly Station Road	TRIVANDRUM 695001	32 27